

# Key Factors to encourage the participation of Primary School Girls in Science, Design and Technology

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Boys tend to gain experience of investigating and making things which have scientific or technological aspects of watching and helping men. The toys they are given also build up and reinforce this kind of experience. In the primary school curriculum technology is a creative activity in which the processes of investigating and designing are prominent. In the context of girls working in science, design and technology the activity of designing has two important implications. Firstly it opens the door to a wide range of real life situations which are of special interest to girls. Secondly the activity itself is as immediately accessible to girls as it is to boys.

A survey by the Assessment of Performance Unit (APU) of the leisure activities of children has shown that the experience of boys playing with constructional materials, such as Lego, is twice as frequent as girls. 2) It has been shown that basic experience of shapes and sizes and of materials and structures based on practical 'hand-on' science, design and technology is directly related to children's later abilities in mathematics and physics and to their future aspirations. It is important therefore, that girls should receive positive support to ensure that they are able to participate in science, design and technology on an equal basis.

To encourage this, girls need:

- more time on their own initially to gain experience of things which are already familiar to the boys.
- time to talk over their ideas with their teacher and help to wean them away from the tendency to hand back.
- equal access to materials and equipment, particularly those they are not familiar with, such as hard

materials like wood and metal. This should be carefully monitored, especially in group work situations.

- equal access to help and encouragement from teachers and other adults. Time given to boys and girls should be monitored to ensure equality of attention.
- Activities which add a scientific and technological dimension to everyday objects or events which are already familiar to them, for instance making a working model of a swing.
- to participate in scientific and technological activities which are socially or environmentally relevant such as designing a foot-bridge to provide a safe crossing over a busy road.
- encouragement to recognise that successful achievement in scientific design and technological activities is valued highly like good writing or mathematical problem-solving.

To help girls realise their potential, teachers need to encourage open mindedness within the peer group and among parents, teachers and other adults together with the recognition that girls can pursue scientific and technological activities just as well as boys. Teachers will need to acquire hands-on capability themselves by exploring and trying out familiar science and technology activities through inservice training (3).

## Some role models: take two girls

The most meaningful role models for young children are provided by their peers. In most schools, girls can be found who have successfully completed a practical scientific investigation or tackled a problem requiring a hands-on approach. In some schools where an effort has been made to encourage and facilitate work by girls in science, design and technology this contribution is more consistent. We can begin to see where

and how they participated and the conditions which encouraged them.

Stephanie is six. Her class project this term is on 'animals'. Her group was given a new set of construction materials and at first she was uncertain how to use it. Her teacher let her experiment freely until she was able to make some shapes which did not fall apart. She was then encouraged to try out her idea for making a giraffe, starting with the neck, the head and then building body and legs. Finally she was able to complete her animal and contribute it to the zoo which she and the rest of the group had worked together to make.

During the previous term Stephanie worked on a 'weather' project and made a paper model to detect air movements in the classroom. Later this was used by the class to gauge wind speeds out of doors. Next term she will be able to extend her creative abilities through a class topic on 'useful things'. This will allow her to investigate a wide variety of everyday objects like torches and to work on electricity and magnetism.

Tania is 11. Over the past year her class has been making models which extend their science and technology in directions which in the past have often been reserved for boys. She first worked with two girls making a house from wooden struts. This involved cutting and shaping the wood, then finding out about adhesives and strong connections. As her confidence grew and the 'houses and homes' topic was succeeded by 'movement' she went on to make a wheeled vehicle by herself. With teacher's guidance and encouragement she used a power drill to make accurately centred holes to improve the design of the axles and reduce wobble.

When models are completed, in Tania's class, other children are encouraged to try them out as a group and to test them against previous performance. Tania tested a siege machine working with a

mixed group of boys and girls. In the testing process Tania took the lead in operating the structure, discussing its performance, and making adjustments in the light of suggestions from others. She was able to persist with this detailed investigation, repeat trials several times and learn about the effective use of stored energy.

#### Examples of good practice

Many examples of good practice can be found in primary schools and the following offer some models which may be of use to schools which would like further ideas.

#### Working individually

Sometimes girls benefit from being allowed to work on their own in a separate place. When a class was working on 'movement' and all the other children were occupied in other activities, it was possible to allow Natalia to have some space to work on her own. The teacher saw that no-one interfered and she was able to contribute to the topic by making a vehicle which was strong enough to carry heavy weights. In working alone within a group, girls may initially need the teacher's encouragement to overcome their hesitation and uncertainty about how to begin. They need fair access to any materials which are to be shared and in any dispute over resources or facilities it is important that they are not disadvantaged and discouraged, especially at first when their confidence may be fragile.

#### Two Girls Working Together

Girls will often be happier working together in pairs when there is something new to try out. In planning the building of a bridge, Jade and Bobby-Jo produced their original design together and then discussed it with their teacher before they felt confident enough to go on to the making stage. After reassurance that they were moving in the right direction Jade and Bobby-Jo were happy to make modifications arising from the discussion. They went on to choose their materials

and construct their model without further help until they needed a suggestion from the teacher to carry them on to the next stage.

The teacher then offered them a model car to test the strength of their bridge enabling them to set up some realistic test situations. Later they carried out more complex tests using several cars crossing at the same time.

#### A Girl and a Boy Working Together

Clare and Davied had been working on 'electricity' using batteries, wires and bulbs to investigate simple circuits. They went on to use Lego battery holders, learning how to put the batteries in properly. This helped them understand that circuits did not work when the batteries were not correctly inserted into the holder, how to connect the Lego light bricks to the battery holder and how to check that the batteries were correctly inserted. As their confidence grew they were able to include a motor and to add rear wheel drive to the car they were constructing, eventually running it with headlights blazing. For most of the time their teacher did not need to interfere because they were co-operating well, but when Davied began to dominate the making of the car, while Clare watched, a brief intervention was enough to get them back to sharing the task fairly and to give Clare more hands-on experience.

#### A Large Mixed Group Working Together

Work with their car on an inclined plank allowed this group to co-operate in setting up tests to check predictions. The teacher checked occasionally to make sure that the girls' ideas were considered and acted upon and that they did a fair amount of practical testing. The time given to each pupil was monitored to ensure an equal share. The organisation of science, design and technology in this class was flexible. It met some girls' initial need for security by allowing them to work in friendship groups which enabled them to branch out and try new things. They were able to build up

confidence and experience rapidly and to share knowledge and skills with the rest of the class.

#### Checklist for action

##### Questions to keep in mind

- Is the range of learning experience offered to girls and boys the same in practice?
- Do girls get equal access to materials and resources?
- Do girls get a fair distribution of teacher's time and attention matched to their particular needs?
- Do teachers intervene to redress the balance if girls are inclined to take a passive and secondary role in investigating, designing and problem-solving situations?
- Does work in science, design and technology include a fair balance of activities in which the objects and events used are as familiar to the girls as they are to the boys?
- Do learning materials depict women and girls as equally active and able participants in activities which have scientific and technological aspects?
- Do the topics investigated relate to girls' interest in people and is the relationship with everyday life emphasised?
- Are the efforts of parents enlisted to ensure that the work of girls in science and in technology has their support at home? Is the knowledge and experience of parents in these areas seen as a useful resource for the school?
- Do the children meet appropriate role models like women who are scientists, designers or technologists when they take part in school visits? Are such women invited as guest speakers in school?
- Do women teachers set a good example to girls in dealing with scientific and technological equipment

and resources? Is there the support available through INSET and other sources to help them gain the experience to recognise the opportunities for developing technology in topics such as weather studied?

#### Guidelines for action

- Make sure that girls do not miss out on scientific and technological activities by opting for other work such as extra reading and writing.
- If necessary let the girls collect their own materials initially. In mixed groupings watch materials and resources to ensure that they are not gradually taken over by more assertive boys. Share out responsibility for active investigation and recording so that girl gain hands-on experience and are not restricted to reporting.
- When situations or materials are less familiar to girls give them more time than boys at the beginning. Help them to talk about their ideas and to be clear about what to do. Check the time you spend with girls and boys by objective monitoring or regular observation to ensure that girls really do get their fair share.
- Try single sex grouping at first in situations where girls seem to lack experience. Infants can profit from a 'girls only' time during periods scheduled for play with construction toys. Later, encourage mixed pairs and work gradually toward girls participating equally in larger mixed groups. Help them to assert themselves by ensuring that they are given time and opportunities to express their ideas and take an active role.
- Balance topics to counteract the tendency for science, design and technology to appear predominantly masculine by including investigations of things with which the girls are more familiar. For example a study of 'wheels' can include a look at pushchairs or shopping trolleys as well as trucks.
- Discard pictures, books and illustrations, including those on boxes and work cards, which show women and girls in passive, stereotyped roles. Display illustrations which show them as active and confident in a wide range of practical situations and press publishers to bring this aspect up to date.
- Stress the relevance of science, design and technology to everyday life. For example, in topics such as 'food', 'water' and 'energy' link work closely to the children's own use of such resources. Make opportunities for them to investigate their environment and to develop ideas for improvements both in real situations and through modelling, for instance, litter disposal or improving bridge designs.
- Keep parents informed about the work in these curriculum areas. Make use of displays and exhibitions at parents' evenings to demonstrate the importance of girls' learning in this area and highlight their success. Informally ask for parents' help and stress the need for leisure, home experiences and toys which will encourage girls to gain confidence in designing, building and making simple and safe things. Some of these should be mechanical and electrical.
- Review lists of guest speakers and ask for women speakers to represent, for example, the police or fire services, to act as role models. Contact the local Engineering Council Regional Organisation (ECRO) or Schools and Industry liaison officer through the LEA to get names of women with scientific and technological roles who can be invited or visited.
- Women teachers should set a good example by using technical equipment so that girls do not gain the impression that it needs a man to understand it. Use INSET time to arrange training.

have handbooks of equipment stored in a special place for reference and keep notes when suppliers demonstrate new items. If help is needed when day to day problems arise try to learn how to tackle them next time.

#### References

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